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Describes procedures for using either a fixed or portable ballistic rail to launch dynamically-detonated munitions.

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U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

AMSTE-RP-702-103
Test Operations Procedure 4-2-018 6 April 1993
AD No.

RAIL LAUNCHED MUNITIONS

1. SCOPE.

This TOP describes procedures for using either a fixed or portable ballistic rail to launch dynamically-detonated munitions. This may be done either to test a particular munition against an armor system of known characteristics or to test an armor system against a munition of known capability.

2. FACILITIES AND INSTRUMENTATION.

2.1. Facilities.

Item	Requirement
Ballistic rail	Fabricated from sections of railroad track, steel beam, or bar stock joined end-to-end to form a relatively straight, smooth, continuous rail.
Test site	Area large enough to house the ballistic rail; also providing safety for test personnel with regard to shelters and minimum distances to buildings or other facilities.
Target	Armor plate (e.g., rolled homogeneous) or armor system; thickness or type depending on the type of test.
Protective enclosures	To house and protect test equipment and instrumentation from fragmentation.

Item	Requirement
Rocket motors	To propel test item along the rail using solid propellant. Depending on the weight of the test item to be launched and its required terminal velocity, rocket motor thrust and burn time characteristics must be calculated in order to select the appropriate size and type of motor.
Munitions arming/ detonating circuitry	To initiate the detonator(s) used in the test munition, capable of storing and releasing the energy required to initiate a high-energy detonator. There are three major types of detonator circuits: those requiring an external impact switch, those implementing the test munition's own internal crush switch, and those used for firing tandem warheads.
Rocket motor firing	To deliver current from the rocket motor power supply to the rocket motor ignitors; solid core copper wire recommended, minimum 15 amperes capacity, insulated for 600 volts or better.
Sleds	Fabricated from aluminum and used to carry the rocket motors and test munitions along the rail.
Cameras	High-speed motion pictures capable of recording at a rate of at least 5000 frames per second; high-speed and real-time video.
Operating equipment	Forklifts and cranes for handling targets and rail sections, as required; welding equipment and generators.

2.2 Instrumentation.

Devices for Measuring:	Permissible Error of Measuring Device:
Armor plate thickness	±1.25 mm
Voltage/continuity	±0.5% (volts/ohms)
Sled velocity	±3% of reading
Radiographic data	1.0% penetrometer sensitivity in 0.3 m steel
Obliquity	±0.5 degree

3. REQUIRED TEST CONDITIONS.

3.1 Test Planning.

a. Assemble and review all instructional materials and technical manuals issued with the test item, and review reports of previous tests conducted on similar items.

b. Review the safety assessment report (SAR) provided by the developer to determine whether all hazards have been identified. Coordinate the SAR with the responsible Safety Office to ensure adequacy to begin testing.

c. Review and post on site pertinent Standing Operating Procedures (SOPs).

d. Prepare an operational checklist for the specific test item and situation.

e. Prepare appropriate data collection sheets.

f. Ensure environmental documentation has been addressed, is on hand, or is not required. Conduct site-specific environmental inspections in accordance with implemented environmental requirements.

3.2 Test Preparation.

a. Ensure that all personnel involved in testing are thoroughly familiar with the provisions of all pertinent SOPs and are fully capable of implementing them before any testing begins.

b. Check to ensure that the test item is intact and record pertinent information (i.e., nomenclature, model number, lot number, etc.).

c. Check the calibration of all instrumentation. Record any operational deficiencies and initiate action to correct them.

3.3 Test Controls.

a. Any modifications to the test item explosive train that are necessary for dynamic testing must be accomplished so that the integrity of the explosive train is maintained to simulate the performance of the original configuration. The procedures for these modifications must be properly documented and approved by the responsible Safety Office and Test Center Commander.

b. Observe all safety procedures in accordance with the SAR and range safety regulations.

c. Ensure that a valid SOP is available for any hazardous operation to be conducted.

d. If the size of test munition warrants concern with regard to noise propagation, obtain a radiosonde profile of winds, temperature, and humidity prior to testing to ensure that the test can be conducted within specified noise limits.

4. TEST PROCEDURES.

a. Test Item Modification. Prepare the test item for dynamic firing by modifying the fuse train to accommodate an electrically functioning, high-energy detonator. Install the detonator using any appropriate adapter pieces to ensure the proper fit and location of the detonator.

b. Rail Emplacement (for portable rails only). Using a crane or forklift as required, position the rail sections along the line of fire. Adjust the rail sections until they are level and then fasten them together. Note: Prior to and after rail emplacement, the emplacement site should be geodetically surveyed to ensure that the rail is level. The sections may be welded together; however, some weld grinding may be necessary to ensure that the test item sled and rocket sled slide freely along the rail. Using a brush, apply a thin layer of water-resistant grease to the areas of the rail upon which the sleds will travel.

c. Preparation for Firing. Since various test centers use a number of different methodologies for arming and initiating a rail launched test munition, the steps in this paragraph deal only with the general preparation required for rail launch. It is assumed that personnel from an individual test center will follow their particular arming and initiation procedures.

(1) Ensure that the preparation for camera coverage, velocity recording, and any other required instrumentation is complete and that all personnel responsible for these aspects of the test have moved to appropriate personnel shelters.

(2) Secure the test item onto the test item sled and position the sled on the rail at the required launch distance.

(3) Slide the rocket sled onto the rail until it comes in contact with the rear of the test item sled. The rocket motors should then be securely bolted into the sled.

(4) Run the firing leads from rocket motor launch position on the rail to the firing position (personnel shelter); then short and ground the leads at the firing position.

(5) Use a multimeter at the rocket motor firing end of firing leads to check that they are intact (i.e., showing infinite resistance when they are not shorted at the firing position and a finite resistance when shorted) and showing no voltage.

(6) Connect the rocket motor ignitor(s) to the firing leads.

(7) Insert the ignitor(s) into the rocket motor(s).

Note: Steps 6 and 7 must be done in this order. If the rocket motor ignitors were to accidentally detonate when connected to the firing leads, far less damage and/or injury would occur than if they were already secured in the rocket motors.

(8) All remaining personnel retire to the firing position.

(9) At the firing position, connect the rocket motor power supply to the firing leads.

(10) Ignite the rocket motor(s).

5. DATA REQUIRED.

The precise nature and amount of data required varies with each test. These may include, but are not limited to, the following:

a. Date and time of shot.

b. A description of the test item/target.

c. High-speed, video, and still photo records.

d. A thorough description of the test results as required by the test sponsor.

6. PRESENTATION OF DATA.

Depending upon the test, present data in an appropriate form (i.e., tabular, graphical, etc.) and supplement with diagrams, sketches, still photos, and motion picture records, as requested.

Recommended changes of this publication should be forwarded to Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-TC-D, Aberdeen Proving Ground, MD 21005-5055. Technical information can be obtained from the preparing activity: Commander, U.S. Army Combat Systems Test Activity, ATTN: STECS-DA-ID, Aberdeen Proving Ground, MD 21005-5059. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145. This document is identified by the accession number (AD No.) printed on the first page.

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